

Impact of size-selective mortality on waterfleas (*Daphnia*)

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Size-selective predation is a situation analogous to size-selective fishing. Studying one type of predation (natural) can often tell us something about the other (human-induced).

Introduction of an alien fish predator has decreased the size of mature females in *Daphnia*.

Further investigations will seek to determine whether the observed changes are only plastic or due to genetic changes.

Introduction

Size-selective mortality makes it dangerous to be in the preferred size range of the predator. Changes in growth rate and life history make it possible to spend as little time as possible in the vulnerable size range; thus, if large individuals are targeted, earlier maturation and/or slower growth are likely to evolve. Evolution caused by selecting large individuals has been proposed for several fish species targeted by size-selective fishing gear; i.e. fisheries-induced evolution [1]. Introduced species may also generate shifts in the prey's life history.

The overarching aim of this project is to gain new insight into the processes shaping the community and population structure by studying the species composition and their life history parameters. In this study we explore the changes in life history and population structure in two species of *Daphnia* (Cladocera, Crustacea) caused by illegal introduction of an alien predator.

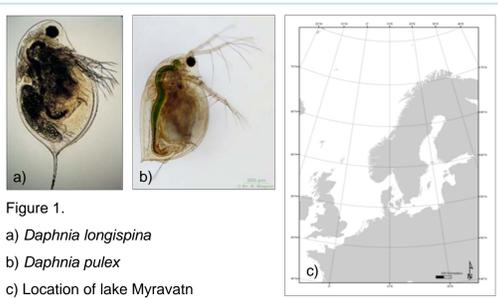


Figure 1.
a) *Daphnia longispina*
b) *Daphnia pulex*
c) Location of lake Myrvatn

Size of mature females has decreased

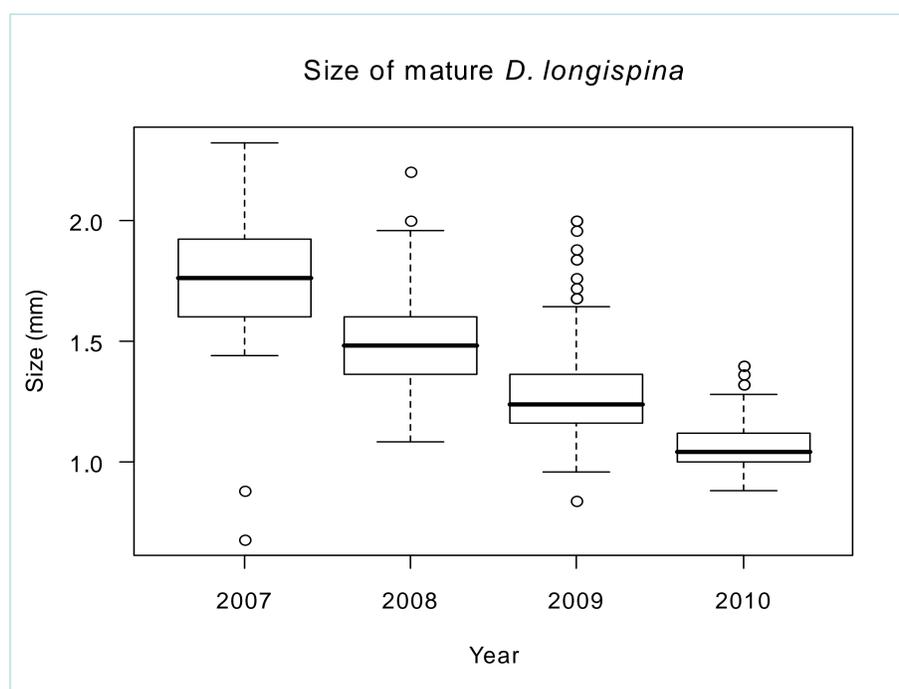
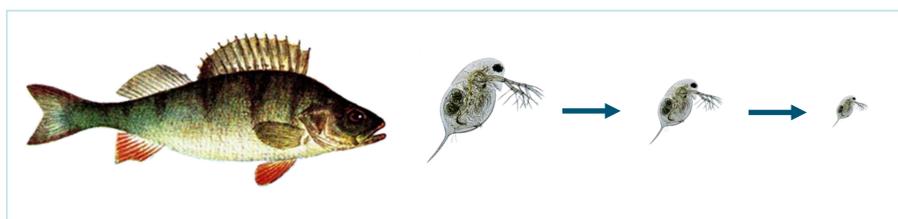


Figure 2. Size range of *D. longispina* with eggs from 2007-2010. The values portrayed are the standard box-and-whisker plot in R, i.e. median, and first and third quartile. Whiskers are max and min values except for outliers. An outlier is defined as 1.5 times the length of the box away from the box. In 2007, right after the introduction, the density of perch was low. The data are based on monthly samples from May to September.



Preliminary result

The size of mature females of *D. longispina* has decreased significantly after the introduction of perch in 2006 (ANOVA, $F_{3,1023} = 531.76$, $p < 0.001$).

Materials and methods

Study area:

Lake Myrvatn – Bergen, Norway (Fig 1 a)

Study species:

Daphnia longispina (Fig. 1 b)
D. pulex (Fig. 1 c)

Introduced predator:

European perch (*Perca fluviatilis*)

Sampling:

Monthly quantitative and qualitative samples from the deepest part of the lake (18 m)

Conclusions

These preliminary results shows that the size of mature females has decreased after fish introduction in 2006. This is in accordance with the expected life-history changes caused by size-selective mortality. Mature, egg-carrying females are conspicuous and particularly vulnerable to fish predation [2]. However, the decrease may also be due to demographic changes caused by higher predation rates on large individuals.

Whether the induced changes in maturation are exclusively plastic or have a genetic basis will be investigated experimentally by determining probabilistic maturation reaction norms [3] for pre- and post-introduction clones.

FUTURE WORK

- Determining probabilistic maturation reaction norms for several clones of *Daphnia pulex* collected before and after an introduction of an alien predator: do we find evidence for genetic change in maturation?
- Influence of food availability and ambient temperature for the probabilistic maturation reaction norms of *Daphnia pulex*
- Clonal life history evolution in *Daphnia pulex* under size-selective harvesting

ACKNOWLEDGEMENTS

Map: Ingelinn Aarnes
Photo: Dr. R. Wagner (*D. longispina* and *D. pulex*)
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